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ABSTRACT

A study compared the effectiveness of charting, or organizing, information into a matrix with that of a read and study strategy. Charting was defined as a strategy in which information is organized into four categories (topic, subjects, main points, and details), thereby showing how ideas are similar and dissimilar. Students enrolled in a university reading/study skills course were randomly assigned to experimental and control groups. Experimental subjects received four hours of instruction, including a booklet and a computer program on charting. The experimental subjects then read a 676 word article, developed a chart for the ideas, studied the chart, and answered 17 multiple-choice questions. The control subjects read and studied the selection, then answered the questions. Two types of text dependent questions were used: within category questions, and across category questions. The results showed no significant differences between groups although the means of the experimental group for both question types were higher than those for the control group. There was a significant difference between question types, indicating that questions based upon ideas explicitly expressed in the texts are easier to answer than questions requiring an integration of information across text. (HTH)

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ORGANIZING INFORMATION INTO A MATRIX:
AN EFFECTIVE STUDY STRATEGY

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Abstract

A review of the literature indicates that organizing information into a matrix, a chart, can be a useful study strategy. Therefore, an investigation comparing charting with a reading and study strategy was conducted in a university reading and study skills course. Although there was no significant difference between the experimental and control groups, the means of the experimental group were higher for both within and across category question types. Furthermore, a significant difference was found between question types when the data was pooled across both groups. This substantiates what other researchers have found, namely that textually explicit questions are easier to answer than questions requiring a reader to integrate information across text.

What can teachers do to enhance students' ability to comprehend, organize, and recall information? One approach is to teach students how to organize information into a matrix, that is, to chart information. Organizing information into a matrix (chart) is a form of active study because it requires a student to reorganize and restructure information into categories.

Definition

Charting is a strategy in which information is organized into categories thereby showing how ideas are similar and dissimilar. Charting requires that students categorize information into four levels: topic, subjects, main points, and details. The topic refers to the most general category of the selection. For example, the selection may be about a person, an event, a place, or a thing. The subjects consist of categories within the topic which are being compared and contrasted. The main points are how the subjects are compared and contrasted. The details are the most specific level, the facts.

Topic: Scandinavian Countries

	Subject: Denmark	Subject: Sweden	Subject: Norway
Main Point: Education	detail	detail	detail
Main Point: Health System	detail	detail	detail
Main Point: Housing	detail	detail	detail

Review of The Literature

Four areas of research indicate that organizing information into a matrix (charting) is an effective study strategy. These areas include research on the effects of prior knowledge, generating questions or summaries, graphic organizers, and text structure.

A schema theory view of reading contends that prior knowledge which includes knowledge a person has about concepts, events, and sequences of events facilitates comprehension. Prior knowledge may serve as an anchoring post for incoming information, thus increasing the probability that a message will be understood. Subjects in the experimental groups in some studies were provided with contextual cues such as pictures or

thematic titles to passages (Bransford & Johnson, 1972; Dooling & Christiaansen, 1977; Dooling & Mullett, 1973; Schallert, 1976; Sulin & Dooling, 1974). The purpose of this procedure was to induce subjects to instantiate an appropriate schema to which the incoming information could be anchored or assimilated. Results of these studies support the contention that a reader's prior knowledge has a facilitating effect on comprehension and recall.

Other researchers have also found that prior knowledge enhances comprehension. Johnston and Pearson (1982) investigated the effects of prior knowledge and the explicitness of text connectivity on measures of reading ability. Results indicated that familiarity of information is an important variable in comprehending text. The eighth grade students who were better readers evidenced more sensitivity to disruptions in the connectivity of text for both familiar and unfamiliar text.

Johnson and others (1985) investigated the contribution of prior knowledge and prereading vocabulary instruction to passage comprehension. In addition, they compared three instructional strategies utilizing readers' prior knowledge (i.e. semantic mapping, semantic feature analysis, and a modified basal approach) to ascertain the effectiveness of

each approach as prereading instructional strategies for vocabulary acquisition and passage comprehension. Results revealed a positive relationship between prior knowledge and reading comprehension. When the fourth grade subjects were grouped by prior knowledge, there was no significant difference between treatment groups for passage comprehension. Furthermore, the higher the level of prior knowledge, the less of an impact for treatment group on comprehension scores. However, comprehension scores of subjects in the mapping and feature analysis groups were higher than scores of students in the modified basal approach.

There is additional research indicating that using graphic aids such as mapping as a training strategy have yielded positive results on measures of comprehension. Mapping is a strategy used to display the meaning of text through a diagram depicting the interconnectedness of ideas in the text. One of the major aspects of mapping is to make students aware of the structure of text as an aid in comprehending and recalling information. That is, mapping can enhance awareness of the macrostructure and the microstructure of text and students can use this structure to help them understand the relationship between ideas and to recall the ideas.

Armbruster and Anderson (1980) directly investigated the

effectiveness of mapping on the reading comprehension of eighth grade students. Eleven students received approximately twelve hours of instruction in mapping expository prose. Results revealed that students in the mapping group recalled significantly more information after 24 hours than students in the control group who used their own method of reading. The results approached significance on the immediate recall of the second passage. In addition, it was found that the probability of recall was higher for mapped than unmapped information.

Rauch and Fillenworth (1980) conducted an investigation comparing mapping with two control groups, self selected strategy and reading. The college subjects received two fifty minute training sessions. Although there was no significant differences between groups, the students in the mapping group had the lowest mean on the standardized reading test and achieved the highest mean on each question type (main idea, subcategories, and details). These results indicated that mapping has potential as a study strategy.

Berkowitz (1986) investigated the effects of four instructional procedures: two experimental procedures (map-construction and map-study) and two control procedures (question-answering and

rereading) on students' recall of expository text. The purpose of the experimental procedures was to teach students to use text organization as a framework to help in recall of information from expository text. The control procedures did not focus on text structure. After a six week training period, the sixth grade students using the map-construction procedure scored significantly better on immediate free recall for one of two expository passages. In addition, when results from students considered as experts at either map-construction or question-answering were evaluated, it was found that students using the map-construction procedure scored significantly higher than students using the question-answering procedure.

It appears that one of the major reasons student construction of a graphic aid such as mapping enhances comprehension is that it promotes active student involvement with text beyond the surface level (Craig & Lockhart, 1972). Other research substantiates that active involvement enhances comprehension and recall of information.

Andre and Anderson (1978-79) indicated no significant difference between a question trained group and a control group for one experiment. However, the types of questions the high school subjects generated did

have an effect. Good text based questions resulted in a higher probability of achieving a higher post test score. Results from a second experiment showed that the question trained group and the question untrained group did significantly better than the control group. The researchers hypothesized that a possible reason for the question generating group scoring higher was that generating questions forced the subjects to process the text at a deeper semantic level. This conclusion was congruent with the conclusion reached by Bean, Singer, Sorter, and Frazee (1982). These researchers investigated the effectiveness of training in summarization rules and self-generation of questions. Although there was no significant difference between experimental and control groups on a multiple choice comprehension test, the eleventh grade subjects in the experimental group did write significantly better summaries.

To summarize, research indicates there are several factors which positively influence comprehension and recall of information. Prior knowledge is one factor. Interactions with text beyond the surface level is another factor. In addition, awareness of text structure and using this structure to develop a graphic aid such as a map depicting the interrelationship between ideas are important factors. Several of these

factors were incorporated into the design of the following investigation.

Purpose of The Investigation

This investigation compared the effectiveness of an experimental study strategy designed to teach students to organize information into a matrix with a control strategy of read and study on students ability to answer two types of questions. The control group received no special training. The experimental study strategy focused on teaching students to use text structure. That is, students were taught to be aware of four levels of information ranging from the superordinate to the subordinate. The four levels consisted of recognizing the topic, subjects, main points the subjects were to be compared and contrasted on, and the details.

Two types of text dependent questions were used: within category questions and across category questions. If a selection contained information comparing and contrasting three subjects (e.g. Norway, Sweden, and Denmark) a within category question would be defined as one in which the question-answer relation would be concerned with one of the subjects. For example, a within category question could be, "What is the main industry in Sweden?" In contrast, an across category question-answer relation would be one in which two or more of the

subjects would be compared or contrasted. For example, an across category questions could be: "What are the differences between the educational systems of Norway, Sweden, and Denmark?"

Subjects

Subjects in the experiment were enrolled in a university reading/study skills course. The subjects were randomly assigned to the experimental and control groups. When the control group was tested, two students did not attend class; therefore, data was collected for thirteen students in the control group.

Students in the experimental group received four hours of instruction. During the first hour, students received a booklet entitled, "Charting: Organizing Information." The booklet contained information explaining the objective of charting, how charting could be used as a study strategy, the advantages of charting, and the procedure for charting. Next, students charted two paragraphs and the results were discussed. Then, charts former students had developed when studying for a variety of courses were presented.

At the end of the first hour of instruction, students were asked to sign a schedule so they could work through a computer program entitled,

"Charting: A Method for Organizing Information." The reason for having them do the program was to ensure they understood how to chart and why charting was a helpful study strategy.

A senior student who worked as a tutor in the Reading Center monitored thirteen of the students in groups of three to five students in a computer lab. Two students had class conflicts with the tutor's schedule so the investigator monitored their progress in a computer lab.

The computer program consisted of a program disk and an adjunct booklet containing nine reading selections which ranged in length from one paragraph to a full page. The ninth selection in the booklet was one page long and the chart for the selection contained too much information for one screen; therefore, the chart was also included in the booklet. The program disk contained three lessons: introduction, practice, and additional ideas.

The Introductory lesson was similar to the information contained in the booklet, "Charting: Organizing Information." In lesson two students read articles and answered questions covering the four levels of information. For the first three articles, students read the article and answered a question directing them to choose the topic from a list of

possible topics (multiple choice questions). After the student chose the topic, the chart would appear on the screen and the topic would be printed on top. Next, the student was directed to choose the subjects from a list of possible subjects. The chart would again appear on the screen and the subjects would be printed on the chart. Finally, students were asked to select the main points from a list. The main points would appear on the screen. The details would automatically be added to the chart. In articles four through eight, the topic was given and the students had to select the subjects, main points, and some of the details. Other details were automatically added. Thus, the lessons became progressively more difficult.

Lesson three contained information on additional ideas. First, ideas when developing charts were presented. Then, suggestions for incorporating visual aids such as pictures and cartoons were included. Next, suggestions for reviewing were discussed.

The investigator conducted the third and fourth day of instruction in the classroom. Students practiced charting articles and discussed similarities and differences in their charts. They answered multiple choice questions on their charts and wrote within and across category

questions. They read their questions to the group.

Students quickly ascertained how to select the topic and subjects of a selection and they were able to select details. In contrast, there were several aspects of the main point level of questioning that differed. First, this was the most difficult part of organizing the ideas in a selection because students had to analyze the article to decide how the subjects were being compared and contrasted. For example, if the article was about men and women in American society, the students had to read carefully and decide on what main points men and women were being compared and contrasted. Second, there were differences involving semantics, that is, students would write their main points using different terminology. However, the terminology would usually be synonymous. Another difference was that students wrote a differing number of main points. If a student wrote fewer main points it was usually because the student collapsed two main points into one main point.

Testing

Testing materials consisted of a 676 word selection about three fictitious groups of people living in outer space. The reason for using such a selection was to try to decrease the effects of prior knowledge.

Students answered seventeen multiple choice questions on the selection. The first question was deliberately written at an easy level to ensure a successful start. It was not included in an analysis of the data. The remaining sixteen questions included eight within and eight across category questions.

The experimental group received a set of directions instructing them to read the article, develop a chart for the ideas, and study the chart. Then, after 30 minutes, they would hand in their work and answer questions on the selection. The control group received a set of directions instructing them to read and study the selection. After 30 minutes they would hand in the selection and answer questions. Both groups were told that if they were through before the 30 minutes were up, they could do other work.

The groups were tested separately by a teaching assistant who worked in the Reading Center. The reason the groups were tested separately was that in a pilot study when everyone was tested together, some students in the control group became very nervous because fellow classmates in the experimental group could write out information while studying the selection used for testing.

Results

There were no significant differences between groups. However, the means of the experimental group for both question types were higher than the means for the control group (see Table 1).

There was a significant difference between question types when the means for the two question types (see Table 2) were pooled across both groups, $T = 4.72$, $p < .000$. This result has substantiated what other researchers have found. That is, questions based upon ideas explicitly expressed in the text are easier to answer than questions requiring an integration of information across text (Pearson, Hansen & Gordon, 1979; Raphael & Pearson, 1982).

Table 1

Means For Both Question Types		
	Control	Experimental
Within Category	6.92 (1.61)	7.60 (.73)
Across Category	5.77 (1.30)	6.07 (1.62)
Total	12.69 (2.50)	13.67 (1.99)

Table 2

Differences Between Question Types When Pooling Across Groups	
Within Category	7.29 (1.24)
Across Category	5.93 (1.46)

Discussion

College students are expected to become independent learners and to be able to display their knowledge when answering a variety of question types. Therefore, students must be cognizant of and be able to utilize a variety of study strategies. The results of this investigation indicate that organizing information into a matrix, a chart, has the potential of being an effective study strategy when ideas are to be compared and contrasted.

The instructional procedure used in this investigation was based upon assertions made by Brown and Palincsar (1982). They state that students should be aware of why a strategy is effective, how the strategy works, and students should be provided with appropriate practice in the use of the strategy. Another dimension added to Brown and Palincsar's instructional strategy was to include charts made by former students to enhance the

probability that students would recognize the effectiveness of the charting strategy and, therefore, use the strategy when studying for various courses.

After the study was completed, the control group received instructions in how to organize information into a matrix (chart). They were asked to write across and within category questions on the practice selections. They were also shown charts made by former students when studying for various courses. Then, the results of the study were presented to all the students. In the subsequent discussion, students indicated that several aspects of the training procedure and seeing the results of the study were helpful. They stated that having to write within and across category questions enhanced their awareness of possible question types instructors could ask. In addition, they said that knowing across category questions were more difficult to answer would serve to increase their study time on comparing and contrasting ideas. Finally, they stated that analyzing charts developed by former students was especially relevant because they could see how charting could be used for courses they had already completed and courses they were presently taking.

If students stated they believed charting would serve as an effective

study strategy for a course in which they were currently enrolled, they were asked to elaborate on what they would chart and how it could be used as a study strategy. Next, they were asked to actually use the strategy and bring their charts to discuss with the class. This relevant instructional method enhanced the probability that charting would be used as a study strategy.

In conclusion, the training procedure used in this investigation and the results of the investigation were used to develop an instructional procedure for teaching students in a reading/study skills course how to organize information into a matrix, a chart. In addition, the instructional procedure was designed to increase students' awareness of why charting was an effective study strategy to use when studying for various courses.

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